Use of anti-pronation taping to assess suitability of orthotic prescription: Case report

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This case report describes a strategy for assessing the suitability of orthotic prescription for individual patients with lower limb overuse injuries. The case concerns a 32 year old male soccer player with a two-year history of Achilles tendinopathy. A functional assessment performed before, during, and after a trial period of anti-pronation taping showed that taping reduced symptoms markedly and resulted in a 10-fold increase in pain-free jogging distance. This was interpreted as an indication for favourable orthotic intervention. Subsequently, orthotic intervention was associated with a similar reduction in symptoms and improvement in function. This case study illustrates how a trial period of anti-pronation taping could assist therapists to make decisions about prescription of orthoses for lower limb overuse injuries. **[Smith M, Brooker S, Vicenzino B and McPoil T (2004): Use of anti-pronation taping to assess suitability of orthotic prescription: Case report. Australian Journal of Physiotherapy 50: 111–113]**

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Introduction

This report addresses a dilemma facing practitioners who treat lower limb injuries that have a putative aetiological basis in abnormal pronation of the foot during gait, and for which orthotics are frequently recommended. The dilemma occurs because of the lack of sound evidence on the clinical efficacy of orthotic therapy, and inconsistent or negative findings of biomechanical changes engendered by orthotics (Heiderscheit et al 2001, McLauchlan and Handoll 2003, Nigg et al 1999, Nurse and Nigg 2001, Stacoff et al 2001). Furthermore many of the clinical criteria once held to be indicative for orthotic prescription, such as sub-talar neutral positioning and measures of varus and valgus of the foot, have been shown to lack reliability and validity (Evans et al 2003, McPoil et al 1998, McPoil and Hunt 1995).

This report outlines a procedure that is used clinically to assist in overcoming this dilemma, but which is yet to be evaluated formally. The procedure involves three steps. First, the physical activity with which the patient has pain and difficulty (the main pain-provoking factor which is often the reason for seeking help) is identified and quantified so as to be used as a clinical outcome measure. The therapist then observes the movements of the lower limb during this activity to determine if the patient's foot pronates excessively. Finally, the therapist applies anti-pronation taping and evaluates its effect on the elected outcome measure. An immediate and substantial reduction in pain and improved ability to perform the previously pain provocative activity (i.e., the outcome measure) is seen as an indicator of a high probability of success with anti-pronation orthotics. This case report highlights a method of making decisions rgarding orthotic prescription that can be easily employed in clinical practice.

Method

Subject The subject was a 32-year old male competitive soccer player with a right grade two (Roy and Irvine 1983) Achilles tendinopathy of two-year duration. He presented with pain over the Achilles tendon aggravated by soccer, netball and jogging, and tenderness to direct palpation a few centimetres proximal to the calcaneal insertion. Physical examination revealed abnormal pronation as observed visually by a physiotherapist during static (standing) and dynamic (walking, jogging and hopping) activities. The subject exhibited bilateral fore-foot and right rear-foot pronation. The Institutional Research Ethics Committee provided ethical clearance and the subject provided informed consent prior to enrolment into the study.

Anti-pronation taping The anti-pronation taping was in the form of three reverse sixes (Figure 1) which has previously been shown to increase vertical navicular height eliciting an anti-pronation effect (Vicenzino et al 2000, Vicenzino et al 1997). A reverse six consists of a 38 mm Leukosport[(a)] zinc oxide adhesive tape originating at the medial malleolus, coursing anterolaterally over the foot, then under the mid-foot and finally up the medial side of the foot and distal leg to support the mid- and rear-foot. For effective application, the foot and ankle were positioned and maintained in slight supination while the tape was applied.

Orthotic Three-quarter length heat-mouldable orthotics[(b)] were used bilaterally. A two-degree rear-foot varus pad and a four-degree fore-foot varus wedge were added to the right orthotic. The addition of the wedges and heat moulding customised the orthotic to the subject's foot ensuring a comfortable fit, an important factor in orthotic prescription (Mundermann et al 2001).

Outcome measures Jogging aggravated the subject's pain and was therefore chosen as the primary outcome measure. Distance and time taken to onset of pain over a 23 metre clinic runway was measured with a pre-set maximum distance of 1150 m. This study also evaluated changes on a 100 mm visual analogue scale (VAS) for perceived global treatment effect and pain with application of the anti-pronation

Figure 1. The chosen anti-pronation taping was in the form of three reverse sixes (Vicenzino et al 1997; Vicenzino et al 2000). Tape application started at the medial malleolus, moving laterally across the foot, under the plantar surface and back up the medial side to anchor on the distal one-third of the leg. Circumferential tape was then applied to lock in the reverse sixes.

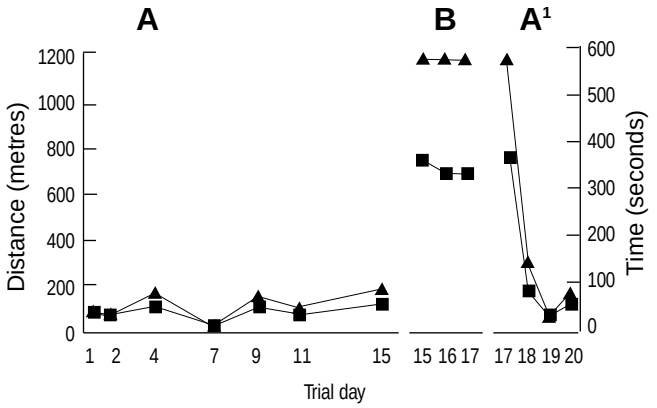

Figure 2. Physical function measures of jogging (distance in metres = triangles, time in seconds = squares) in the ABA' study design. Days of the study are indicated on the horizontal axis and running distance and time on the vertical axes. The jogging test was limited to 1150 m.

orthotics. The perceived global treatment effect was anchored at 0 by the phrase '6 weeks prior to the study' and 100 mm by 'completely resolved.' The patient was asked to rate the status of his condition along this scale. The worst level of pain experienced while playing a game of soccer and after jogging was also rated on a 100 mm VAS. The VAS was anchored with 'No pain' at 0 mm and 'Most pain imaginable' at 100 mm.

Research design and protocol An ABA' study design was used to determine the initial effect of anti-pronation taping on jogging. The A phase consisted of a two-week baseline period of data collection to establish the level, variability, and any trend prior to the anti-pronation taping intervention. Phase B involved the repeated application of the anti-pronation taping over three consecutive days. A follow up phase (A') of three days in which the taping technique was not applied and outcome measures were recorded was also included. This single case study design has previously been used in physiotherapy research (McPoil and Cornwall 1991, O'Brien and Vicenzino 1998).

In addition to the ABA' component of this case study, a follow up was included to determine if improvements seen with the anti-pronation taping were also present during orthotic therapy. This follow up period lasted 31 days after the orthotic was applied.

Data analysis The primary analysis for this type of study involves the visual assessment of the data for level, variability, and pattern of response across time and between phases (Ottenbacher 1986). The data were plotted against time and analysed visually. The double standard deviation method was used as a guide to establish that differences between phases existed (Ottenbacher 1986). That is, a difference beyond that attributable to chance is deemed to occur if the difference between intervention (phase B) and the reference phase is greater than two standard deviations of the baseline phase.

Results

The mean jogging distance before application of tape (phase A) was 117.6 m (SD 52.5), during application of anti-pronation taping (phase B) was 1150 m (SD 0 as the subject reached the pre-determined end-point of the test on each occasion), and following the removal of tape (phase A') was 425.4 m (SD 491) (Figure 2). The difference between means of phases A and B was far in excess of two standard deviations of phase A. The change in time taken to jog to pain onset paralleled distance data (Figure 2).

On the initial jogging test following removal of the anti-pronation taping (phase A') the subject completed the 1150 m jogging test without onset of Achilles tendon pain. This value was the same as that attained with the anti-pronation taping (phase B) and substantially different to the ensuing data of 184 m (SD 109.7) for the distance jogged in the follow up phase A'. Excluding this first jogging test, the mean jogging distance in phase A' had returned to within two standard deviations of the baseline data (phase A).

The subject's perception of improvement as indicated by perceived global treatment effect did not change throughout phase A (baseline) from a level of six weeks prior to the study. Following fitting of the orthotic there was a 100% change in perceived global treatment effect score. The subject reported no change in status on repeated measures throughout phase A (baseline), but indicated 73% improvement on the scale subsequent to fitting of the orthotic and 100% improvement after the four-week follow-up period. The subject was also able to complete the 1150 m clinical jogging test on each occasion without experiencing pain with the permanent orthotic in place.

Mean pain VAS scores during soccer changed from 29.3 mm (SD 4.7) in phase A to 0 mm (SD 0) in the 4-week follow-up

with the orthotics. Similarly, VAS scores for pain after jogging were 13.5 mm (SD 21) during phase A and 0 mm (SD 0) with the orthotic in place. The differences in these mean VAS scores between phase A and the longer term follow up phase in which the patient had the orthotic in place exceeded the 2 SD of corresponding mean data at baseline (phase A).

Discussion

With the application of anti-pronation taping there was an immediate improvement in jogging distance that was approximately 10 times baseline distance with no pain reproduction. Clinically, such a rapid positive improvement in signs and symptoms with anti-pronation taping can be taken as an indicator that anti-pronation orthotics may be of benefit. Indeed, in this single case report, the response of the patient's condition to subsequent orthotic therapy was found to be positive with a sustained reduction in pain during jogging and soccer. This is a single case example of the use of anti-pronation taping to predict the outcome of orthotic therapy. However, the effect of orthotic therapy was assessed for only 31 days and therefore does not evaluate the longer-term outcomes of this intervention. It is intended that these preliminary data may be used to stimulate further, more controlled studies.

The marked improvement in jogging distance and time with the application of anti-pronation taping in phase B had substantially abated in phase A'. These results confirmed that there was no spontaneous resolution of the patient's condition over the ABA' period and that the change reported during the anti-pronation taping application period was not likely due to natural resolution of the condition. Furthermore, it points to the transient effects of the anti-pronation taping technique. An interesting finding was the improved jogging distance without anti-pronation taping in the first test in phase A'. This temporary carry-over effect is commonly seen in clinic and is possibly due to short-lived adaptations in the neuro-motor and pain systems and/or soft tissue, which if not reinforced with ongoing therapy remain a transient feature in the time course of the patient's condition.

This case report suggests that anti-pronation taping may have a role in predicting the outcome of successful orthotic therapy. Anti-pronation taping can be applied to overuse injuries to assist in confirming a relationship between observed abnormal biomechanics and reported pain as a means of ascertaining the degree of confidence with which orthotic therapy may be recommended to the patient. A marked improvement in the functional outcome measure when anti-pronation taping is applied confirms the proposed plan for treatment, enhancing confidence and patient compliance, whereas a negative test may prevent inappropriate intervention and allow the practitioner to consider other avenues of treatment. To effectively use this process clinically it is essential to choose patient-specific aggravating activities as outcome measures. These individual outcome measures should be used to establish a baseline index from which to test the effectiveness of the anti-pronation taping and subsequent orthotic therapy.

This report provides a practical example on which practitioners may wish to model their decisions regarding orthotic therapy in clinical practice.

Footnotes [(a)]BDF, Australia [(b)]Vasyli Custom Orthotics, Vasyli International.

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